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Cercariae from *Coretus corneus* (L.) in the environments of Warszawa

Cerkarie z *Coretus corneus* (L.) okolic Warszawy

Cercariae from the environments of Warszawa have been investigated so far only by Sinicyn (1905). Unlike this author, who examined them in a somewhat casual manner from several species of snails, I limited myself to an accurate and detailed study of cercariae from *Coretus corneus* (L.) only.

I carried out my investigations in 1937 and 1938, at the Department of Systematic and Morphological Zoology of the University of Warszawa, which at that time was under the care of Professor Dr. Wacław Roszkowski. I am greatly indebted to Professor Dr. W. L. Wiśniewski, now in charge of the Department of Parasitology of the University of Warszawa, for his most valuable criticisms and advice.

Eco-biological part

Between April 1937 and August 1938 I examined 13,122 specimens of *Coretus corneus* L. The snails come from 6 water bodies in, or next to, Warszawa. They included: 1) the Gocławek pond, 2) the river Wilanówka, 3) the canal in Czerniaków, 4) the pond in Marymont, 5) clay pits in Ochota, and 6) the reservoir in Nowosielecka street. The description of the reservoirs given below refers to the years 1937 and 1938.

1. The Gocławek pond is a small water body roughly 400 m. long and about 40 m. wide; it is drained through a canal to the river Vistula. The bottom is silty, the littoral zone is overgrown with rushes, reeds, calamus, and waterthyme. The banks are fairly high and border upon meadows in the west, and with fields and buildings in east. The fauna is profuse and waterfowl is conspicuously present (wild ducks, mews) nesting in the rushes and neigh-

bouring marshes. I noticed no domestic waterfowl, although they are likely to visit the pond occasionally, as may be judged by the presence of buildings in the neighbourhood. In summer, the pond was used for bathing. *Coretus corneus* was found in relatively large numbers, and the specimens attained a considerable size (shells 37 mm. in diameter). From this site, I collected 3,800 specimens.

2. The river Wilanówka is in fact a rivulet rather, overgrown with rushes and calamus, with low banks and silty bottom. It flows through the Wilanów Park, across meadows and into the river Vistula as its left tributary. There was waterfowl, wild as well as domestic. The snails were numerous, especially in the littoral zone, and I took here 5,334 specimens of *Coretus corneus*.

3. The canal at the Czerniaków housing estate, 1.5 km. long and 2 m. wide, has a bog-type bottom and banks thickly overgrown with aquatic plants. The canal divides large areas of wet meadows from higher lying pastures. It was visited by wild and domestic waterfowl. *Coretus corneus* was less frequent than in the former two reservoirs, and I collected 1922 specimens.

4. The Marymont pond, formerly a branch of the river Vistula, is 400 m. long and 40 m. wide. Banks are fairly high and on the east side overgrown with shrubs and rambling plants. On either side there are meadows and the south side is bordered by a road and buildings reaching almost to the water. In summer, it is overgrown with algae and waterthyme. The fauna consists of amphibians and fishes. *Coretus corneus* was present in rather small numbers; I collected 1803 specimens.

5. The clay pits in Ochota have low and wet borders overgrown with rushes and reeds. The bottom is silty, the water turbid and cold. They are situated amidst fields; fishes and amphibians are few, and the pits are not visited by birds. A road carrying considerable traffic passes nearby. *Coretus corneus* were few on this site, and I collected only 246 specimens.

6. The reservoir in the Nowosielecka street is produced by overflow from the Czerniaków lake, and is in summer almost completely dry. It lies amidst pastures and meadows. *Coretus corneus* occurred in small numbers and size. I collected on this site 845 specimens.

The water bodies referred to may roughly be divided into two types: those of a natural character (the Gocławek pond, the river

Wilanówka, and the canal at Czerniaków) and those of an artificial character (the Marymont pond, the clay pits in Ochota, and the reservoir in the Nowosielecka street).

In the snails I examined, I found 9 species of cercariae and 3 species of metacercariae:

Monostomata:	1. *Cercaria ephemera* Nitzsch
Echinostomata:	2. *Cercaria spinifera* La Val.
Xiphidiocercariae:	3. *Cercaria pilosa* sp.n.
	4. *Cercaria pseudogracilis* n.nov.
Furcocercariae:	5. Cercaria of *Bilharziella polonica* Kow.
	6. Cercaria of *Cotylurus cornutus* Rud.
	7. *Cercaria linearis* Wes. — Lund
	8. Cerc. of *Tylodelphys excavata* (Rud.)
	9. *Cercaria vilanoviensis* sp.n.
Metacercariae:	1. *Echinostomum* sp.
	2. *Xiphidiometacercaria* sp.
	3. Tetracotyle of *Cotylurus cornutus* Rud.

Cercariae occurred as rule separately in the snails, and there were only two cases where two species were found in the same host:

C. pilosa + cercaria of *Cotylurus cornutus,* and

C. pseudogracilis + cercaria of *Bilharziella polonica.*

On the other hand, the tetracotyle of *Cotylurus cornutus* occurred very frequently together with cercariae of other species, viz., *C. ephemera, C. spinifera, C. pilosa, C. pseudogracilis,* cercaria of *Tylodelphys excavata,* with metacercariae of *Echinostoma* sp. and *Xiphidiometacercaria* sp.

General infestation of the snails with the larvae of the flukes was 6.6 per cent.

The species most frequently found in the snails were: *C. pilosa* (3.5%), *C. ephemera* (1.0%), *C. spinifera* (0.9%), *C. pseudogracilis* (0.4%). Other cercariae, especially Furcocercariae, were found less frequently, and their percentage was sometimes insignificant. As regards Furcocercariae, most extensive infestation was noted for cercaria of *Cotylurus cornutus* (0.24%), and cercaria of *Tylodelphys excavata* (0.16%); the other were found in very small numbers. Metacercariae were usually found separately, occasionally together with the cercariae of other species.

The two groups of water bodies referred to before have an analogy in two types of cercaria fauna. In reservoirs of a natural

character, cercariae of all the species were found, differences being restricted to frequency of infestation only. In reservoirs of an artificial character, only *C. pilosa* were found.

This fact indicates that invasion depends upon the ecological character of particular reservoirs, but the immediate cause of the occurrence of particular species was the presence of final and intermediate hosts. The presence of *C. pilosa*, found in all the reservoirs, is associated — I may assume — with amphibians. Other species, especially Furcocercariae and Echinostomata cercariae, depend upon birds as final hosts.

Reservoirs of a natural character have a fairly rich fauna of cercariae, whereas reservoirs of an artificial character have a poor fauna of hosts which reduces the number of species represented by the cercariae.

Wesenberg-Lund quotes a list of cercariae found in *Coretus corneus* in Danish water bodies. As will be seen from a comparison, environments of Warszawa are richer by having *C. pilosa*, *C. vilanoviensis*, cercaria of *Cotylurus cornutus*, cercaria of *Tylodelphys excavata*, but poorer by having neither *C. splendens* nor *C. frideriksborgensis*. The above list should be supplemented by Sinicyn's data, who found in the environments of Warszawa *C. prima* in *Planorbis albus* and *Coretus corneus*. Wesenberg-Lund also reports *C. prima* from *Coretus corneus*, whereas the cercaria is absent from my list. Nor did I find *Parafasciolopsis fasciolaemorpha*, described from *Coretus corneus* from Polesie by Wiśniewski (1937). I should like to mention that Lutta reported from *Coretus corneus* from Peterhof: Cercaria of *Echinostoma revolutum*, *C. trivolvis* Cort, *C. ornata* La Val., *C. stylosa* Linst., *C. limnaeae-ovatae* Linst., and *C. burti* Mill., known from other species of molluscs.

Over-all invasion by cercariae of *Coretus corneus* in all the reservoirs I investigated was as follows:

Months 1937	V	VI	VII	VIII	IX	X	XI	XII
percentage of infected snails	7.3	8.5	10.7	12.2	6.9	5.0	5.5	1.3
Months 1938	I	II	III	IV	V	VI	VII	VIII
percentage of infected snails	—	—	4.8	6.2	5.5	7.0	6.9	6.4

In both years, invasion was at a maximum in the summer months June, July and August, and was higher in 1937 than in 1938. The differences are associated with fluctuations in invasion peculiar to every species of cercaria. In order to make the differences more distinct, I shall give the relevant data for each species separately.

Infestation with *Cercaria ephemera* was more or less on the same level throughout the whole year. In the Gocławek pond, it was in 1937 3.6%, and in 1938, 1.9%; in the river Wilanówka 0.9 and 1.0%, and in the Czerniaków canal 2.1 and 1.0% respectively.

Infestation with *C. spinifera* was also more or less the same throughout the entire year, but a conspicuous rise was noted in the months July and August in the Czerniaków canal, which also had the highest percentage of infested molluscs. Frequency of infestation in the Czerniaków canal, 8.9 and 6.5%, in the Gocławek pond, 1.2 and 0.7%, and in the river Wilanówka, 3.1 and 0.2% for 1937 and 1938 respectively.

C. pilosa, most common as a parasite of *Coretus corneus* in the environments of Warszawa shows a distinct rise in frequency of infestation in the summer months; maximum is in June, and minimum, in late autumn and in spring. This pattern is very much alike in all water bodies. The frequency of infestation was in the Gocławek pond 6.8 and 2.7%, in the river Wilanówka, 7 and 6.3%, in the Czerniaków canal, 3 and 3.7%, and in the Marymont pond, 1.7 and 2.7%, for 1937 and 1938 respectively. *C. pilosa* was present throughout the whole year.

The pattern of infestation is for *C. pseudogracilis* not very much different. In the Gocławek pond the figures were 2.5 and 1.6% in 1937 and 1938 respectively. In the river Wilanówka, the species was found only in 1938 in 0.7% of snails. The cercaria was found all the year round in an insignificant percentage of snails.

Cercaria of *Cotylurus cornutus* was most frequent in the river Wilanówka, infesting 0.7 and 0.8% of the molluscs in the years 1937 and 1938 respectively. Cercariae were found all the year round, and frequency was 0.7 and 1.1%, in 1937 and 1938 respectively.

Cercaria of *Tylodelphys excavata* and *Cercaria linearis* were rare. I found the former species throughout the whole year in the river Wilanówka, and the other only in July and August.

By summing up the data referred to above we may conclude that infestation definitely rises in the summer months. This concerns all species and is especially conspicuous in *C. pilosa*, which showed maximum frequency of invasion in June. The regular shape of the infestation curve is due to the fact that final hosts are amphibians or birds, always present in the water bodies investigated. Flukes cease to produce eggs in autumn, whereas infection with miracidia is unobstructed from spring until autumn.

Development of cercariae depends on the temperature of the environment and on the physiological condition of the snail. In investigating the effect of the environment on the development, I arbitrarily assumed 3 stages of development: mature, semi-mature and immature.

As mature cercariae, I considered those with fully developed anatomical features, not subject to deformation in water, and rapidly swimming by carrying out vigorous movements with their tails. The mature stage was easy to distinguish. In reaching the stage, there was coincidence in time for all the cercariae, and all cercariae in sporocysts or rediae did reach the stage. An exception was *C. ephemera*; mature cercariae of this species were found in insignificant numbers all the year round.

In the semi-mature stage, I reckoned cercariae anatomically not yet fully developed. In addition to the predominating numbers of immature sporocysts or rediae, there were also occasional mature cercariae. Their movements were on the whole sluggish, tail movements especially so.

Immature cercariae were easy to recognize, since they were usually found as more or less developed anlage in their parthenitae.

As a rule, mature cercariae were found from May to September, although I found also in these months numerous immature stages. Development does not run a uniform and identical course and, therefore, over the period from spring to autumn all three stages of development could be found, but I failed to find in the molluscs mature stages in the winter months, although the water in which they were kept in the laboratory was between 12 and 14°C. As a general natural factor, ambient temperature does affect the development of cercariae, but it is not the only factor. In snails which were kept over 4 to 5 months (November 1937 — March 1938) in a temperature much above that outside, I found in these months no adult cercariae. Consequently, dyna-

mics of development depends also on factors other than temperature. It seems to me that it depends primarily on the physiological state of the host. It should be noted that the snails were not fed during that time and were semidormant.

As a factor influencing the development of flukes, temperature may account, however, for the relation between the growth of cercariae and the season. Assuming infection to take place in spring, then, in connection with the rise of temperature towards the end of spring (May), development is accelerated and mature forms of cercariae are found in summer months (June and August).

In my material, immature stages predominated over the mature ones. Prevalence of snails harbouring immature cercariae appears to indicate that a large proportion of snails perish before the cercariae reach maturity. Comparison of perished specimens of *Coretus corneus*, infested with non-infested ones, warrants the conclusion that specimens infested with Furcocercariae perish more often than those infested with *C. ephemera* and *C. pilosa*.

In order to explore the possible relationship between the size of a snail and frequency of infestation, I measured all the specimens under investigation before dissecting them. I took measurements from the widest part of the shell, and the figures obtained ranged between 11 and 37 mm.

Size in mm.	Examined	Infested	%
11 — 20	261	7	2.6
21 — 30	7035	386	5.4
31 — 37	5826	480	8.3

Most of the snails examined were average in size, but large specimens were most frequently infested. This analysis appears to confirm the view expressed by some authors (Rotschild, 1936) that the parasites stimulate the host's growth. However, the higher proportion of large snails invaded by flukes may also be attributed to the fact that chances of infestation with miracidia grow with age.

Systematic part

Monostomata — Cercariae

1. *Cercaria ephemera* Nitzsch, 1807 (Figs. 1, 1a and 1b)

The cercaria was investigated by numerous authors such as Nitsch (1807), Linstow (1896), Cort (1915), Szidat (1930).

Wesenburg-Lund (1934) described it in detail and carried out experiments concerned with encystment. Szidat assumed that the adult form is *Notocotylus thienemanni* L. et U. Szidat, a fluke developing in the caecum of geese and ducks.

Dimensions of cercariae	Contracted	Relaxed
Length of body	302—377 μ	733 μ
Width of body	181	226
Length of tail	604	830
Width of tail	53	75
Oral sucker	45	45
Rediae	1130×221	
Pharynx of rediae	90×60	

The cercaria is somewhat smaller than described by Wesenberg-Lund, suckers are of the size quoted by this author, but the rediae are somewhat longer. Absence of penetrating glands is a characteristic feature. In the anterior part of the body, less intensively stained, in the vicinity of the sucker and three pigmented spots, there may be distinguished two symmetrically arranged intestinal branches leading from the area near the oral sucker and extending underneath the excretory canals. The excretory canals, filled with small corpuscles, unite mutually behind the oral sucker and lead in the posterior part into the excretory vesicle. Flame cells are visible only in the posterior part of the body. Unlike mature cercariae, young ones are transparent and have a bright grey shade. However, even in that stage, pigment accumulates in the anterior part of the body; it is grouped in two shapeless spots, increases gradually and takes a brown shade, especially conspicuous in the eye-spots.

Rediae are large and have a well developed oesophagus and a long intestine runing to the end of the body. In the rediae, there are numerous anlagen of cercariae (roughly 25). The cercariae mature in the snail's liver outside the rediae which they leave at a relatively young stage.

Mature cercariae I found from May to November, and they predominated in August and September. I found no adult cer-

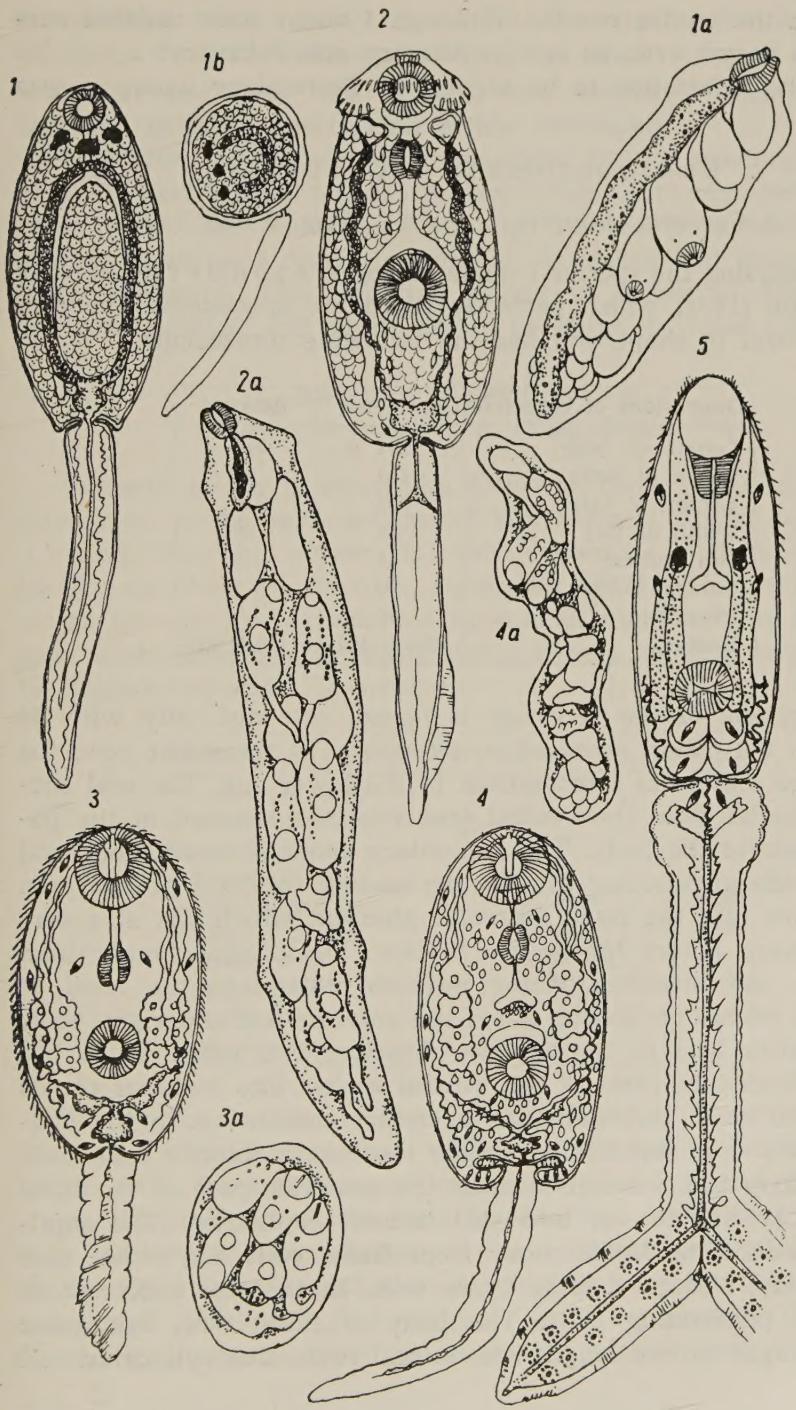

Fig. 1. *Cercaria ephemera* Nitzsch. 1 a — redia, 1 b — metacercaria. Fig. 2. *Cercaria spinifera* La Val 2 a — redia.
Fig. 3. *Cercaria pilosa* sp.n. 3 a — sporocyst. Fig. 4. *Cercaria pseudogracilis* n.nov. 4 a — sporocyst.
Fig. 5. Cercaria of *Bilharziella polonica* Kow.

cariae in the winter months, although I noted some isolated cercariae to encyst even as late as January and February.

I found infestation to be highest in Czerniaków where it was 1.5%.

Echinostomata — Cercariae

2. *Cercaria spinifera* La Val. (Figs. 2 and 2 a)

In analysing the species I made use of Wesenberg-Lund's description (1934) which perfectly fitted my specimens. The cercaria is oval in shape and has the following dimensions:

Dimensions of cercariae	Contracted	Relaxed
Length of body	182 μ	540 μ
Width of body	182	45
Length of tail	302	330
Width of tail	45	30
Oral sucker	45	
Ventral sucker	70	
Pharynx	70	
Rediae	980 × 350	1190 × 270

The cuticle of the cercariae is naked, provided only with 34 spines on the collar, arranged in two rows. In the upper row, the spines are somewhat shorter than in the lower one. The oral sucker is smaller than the ventral one, which is situated in the posterior half of the body. The alimentary canal is conspicuous and begins with a muscular broadening leading into the prepharynx, and thence into the large muscular pharynx which lies at a certain distance before the ventral sucker. Oesophagus longer than pharynx, and branches of the intestine extend to the level of the large excretory vesicle. From the anterior left and right walls of the latter lead in the anterior direction two tubes which become extended in front of the ventral sucker into tortuous canals filled with small but numerous excretory corpuscles. In the vicinity of the oral sucker, the canals taper into thinner canaliculi, make a loop and descend towards the posterior part of the body where they branch out into still thinner capillaries. The capillaries conduct the liquid away from flame cells. On either side of the body, I found 8 large flame cells. In the oral sucker there are 6—8 penetrating cells. The body is filled with cystogenic cells arranged in two length-wise lateral rows. The cylindrical tail

is equipped with a fairly broad fin. Terminally, the fin tapers off into a fin-less caudal appendage 23 μ. long.

Rediae are large and have a well developed pharynx. The intestine is short, procruscula feebly developed.

Extensity was highest in Czerniaków (3.0%), reaching a peak in April 1947 (10%). I found metacercariae of *C. spinifera* in *Coretus* of the Marymont pond, although I found no cercariae in it. Mature cercariae I found in summer; in spring and autumn they were immature. The cercariae belong to flukes of the family *Echinostomatidae*, and adults are to be found in ducks *(Anatidae)*.

Xiphidiocercariae

3. *Cercaria pilosa* sp.n. (Figs. 3 and 3 a)

Cercaria pilosa is most like *Cercaria prima* Sin., found by Sinicyn in the environments of Warszawa in *Aplexa hypnorum* (L.) and *Planorbis vortex* (L.) var. *compressa*, and rediscovered by Wesenberg-Lund in Danemark (1934). The separateness of the two species is confirmed by smaller dimensions of *C. pilosa* sp.n. Both cercariae are undoubtedly closely related; both belong to Xiphidiocercariae — ornatae.

Dimensions of cercariae	Contracted	Relaxed
Length of body	82—110 μ	210 μ
Width of body	70— 75	35
Length of tail	45	165
Width of tail	22	11
Oral sucker	30 × 30	37 × 32
Ventral sucker	21 × 21	23 × 23
Stiletto	21	
Prepharynx	16 × 12	21 × 10
Pharynx	12 × 12	
Sporocysts	317 × 75	

This is the smallest of the cercariae found in *Coretus corneus*. The body is thickly covered with thin retrograde bristles, their length is in the anterior part of the body 4—5 μ. and grows towards the hind part of the body to 12 μ. The oral sucker is larger than the ventral one, situated in the posterior part of the body. Of the alimentary canal I was able to note only the long prepharynx, well developed pharynx, and short oesophagus. Unlike in *C. prima*, intestinal branches were still undeveloped, but when

the body was suitable oriented, I was able to note 2 bright tubes as the anlage of the future intestine, not yet clearly outlined against the surrounding mass of cells.

Excretory vesicle Y-shaped, with two long branches, almost continuously filled with excreta. From the canals leading from the vesicle, leave at the level of the ventral sucker two further canaliculi. The anterior canaliculus reaches the oral sucker, and the posterior one extends to the end of the body where it branches into still thinner capillaries. Flame cells are arranged bilaterally in eights. Penetrating glands are arranged in six pairs on both sides of, and before the ventral sucker. From each cell leads an efferent duct which ends at the blade of the stiletto which is all along of uniform width, but extends in the anterior part to 4 μ. Cystogenic cells, of pronounced optical refractivity, are scattered in the body, more closely arranged in the posterior part. Tail, shorter than the body, is provided with a dorso-ventral fin which begins at the tail's base.

Sporocysts are very small, spherical in shape and contain 8—20, or more, anlagen of cercariae.

The cercaria is the most common parasite of *Coretus* and over-all infestation was 3.7%. I found them most frequently in Czerniaków (5.2%) and in the river Wilanówka. Extensity of infestation is highest from June to August, and in these months mature forms are most numerous. The cercaria is very tolerant as regards external conditions. The liver of an infested snail, removed and kept in a Petri dish at 5.7°C., harboured even on the fourth day live and mobile cercariae.

4. *Cercaria pseudogracilis* n.nov.
(*Cercaria gracilis* Wes.-Lund, 1934) (Fig. 4)

The cercaria was originally described by Wesenberg-Lund as *C. gracilis*. This was an oversight, since the name had been reserved by La Valetta for a Furcocercaria. Consequently, I changed the name *C. gracilis* to *C. pseudogracilis* n.nov. The cercaria belongs to Xiphidiocercariae-armatae. In describing the cercaria, Wessenberg-Lund made the reservation that he met with some variability in the number of penetrating glands (4—5 pairs), and he suspects that his cercariae represent two different species which have been confused.

The body is set with spines, in the form of obliquely arranged plates and with small spines of uniform length (about 3 μ) sticking out between the former spines. The oral sucker is larger than the ventral one situated in the posterior part of the body. The alimentary canal consists of a pharynx, oesophagus and two short intestinal branches. The prepharynx is equal in length to the pharynx. The excretory vesicle, Y-shaped and provided with

Dimensions of cercariae	Contracted	Relaxed
Length of body	180 μ	370 μ
Width of body	105	76
Length of tail	76	302
Width of tail	30	15
Oral sucker	54	
Ventral sucker	45	
Stiletto	28 × 5 (base)	
Sporocysts	1000 × 100; 1350 × 300; 180 × 150	

two branches, is notably muscular. From the branches of the vesicle lead two wide lateral canaliculi, which fork at the level of the oral sucker on either side of the body into one duct leading in the direction of the oral sucker, and another one leading to the posterior part of the body. I counted 12 pairs of flame cells. The penetrating glands consist of 6 pairs of large cells, three pairs on either side of the ventral sucker. Cell nuclei are large, their body is lobularly corrugated and the plasma homogeneous. From each cell leads a long efferent duct ending in the oral sucker.

The tail is cylindrical, of an identical diameter almost over its entire length, and begins in concavity in the body's end. At the site of attachment, there are muscle fibres resembling at first sight minute thorns. I was able to recognize their true character only after continued observation. I found similar muscle fibres also in *C. pilosa*. The cystogenic cells are grouped in the posterior part of the body. Sporocysts are large, brown and contain numerous anlagen of cercariae.

The cercaria was found frequently in the Gocławek pond, river Wilanówka, and Czerniaków canal. Infestation was highest in June, especially in the Gocławek pond (2.6%). The adult form of the fluke is unknown.

Furcocercariae

5. Cercaria of *Bilharziella polonica* Kowalewski (Fig. 5)

Dimensions of cercariae	Contracted	Relaxed
Length of body	200 μ	300 μ
Width of body	105	75
Length of tail	225	302
Width of tail	60	40
Furca	135	151
Anterior organ	23 × 2	
Ventral sucker	52 × 58	

The anterior part of the body is set with minute spines growing denser towards the apex; on the apex there are three pairs of sensory bristles among them. The anterior organ consists of two sections: a muscular one, and one destitute of muscles. The ventral sucker is smaller than the anterior organ, but is notably muscular and has a characteristic H-shaped depression. The alimentary canal is narrow, intestinal branches are short, and their bifurcation lies in the anterior part of the body. At some distance before the ventral sucker, roughly at the level of bifurcation, there are two non-pigmented corpuscles, believed to represent eyes. Penetrating glands number five pairs; the two anterior pairs, elongated and with granular plasma, begin before the ventral sucker, and the remaining three, of a homogeneous consistence, fill the posterior part of the body. The excretory vesicle is small and bifurcation into the anterior and posterior canaliculi takes place at the level of the ventral sucker. I counted 6 pairs of flame cells, one of which lies in the wider part of the tail. The tail is long, begins with a narrow basis and widens subsequently bubble-fashion. In this "bubble" one may note the arrangement of the muscle fibres responsible for the tail's movements. The furcae are short and equipped with narrow fins. The excreatory duct lead through the centre of the tail's trunk and through the furcae. Sporocysts are long.

Extensity of infestation was low, and I found the cercariae only in the river Wilanówka (0.11%). The cercaria belongs to the family *Schistosomatidae*, parasites of the circulatory system of ducks. It was described by Szidat (1928).

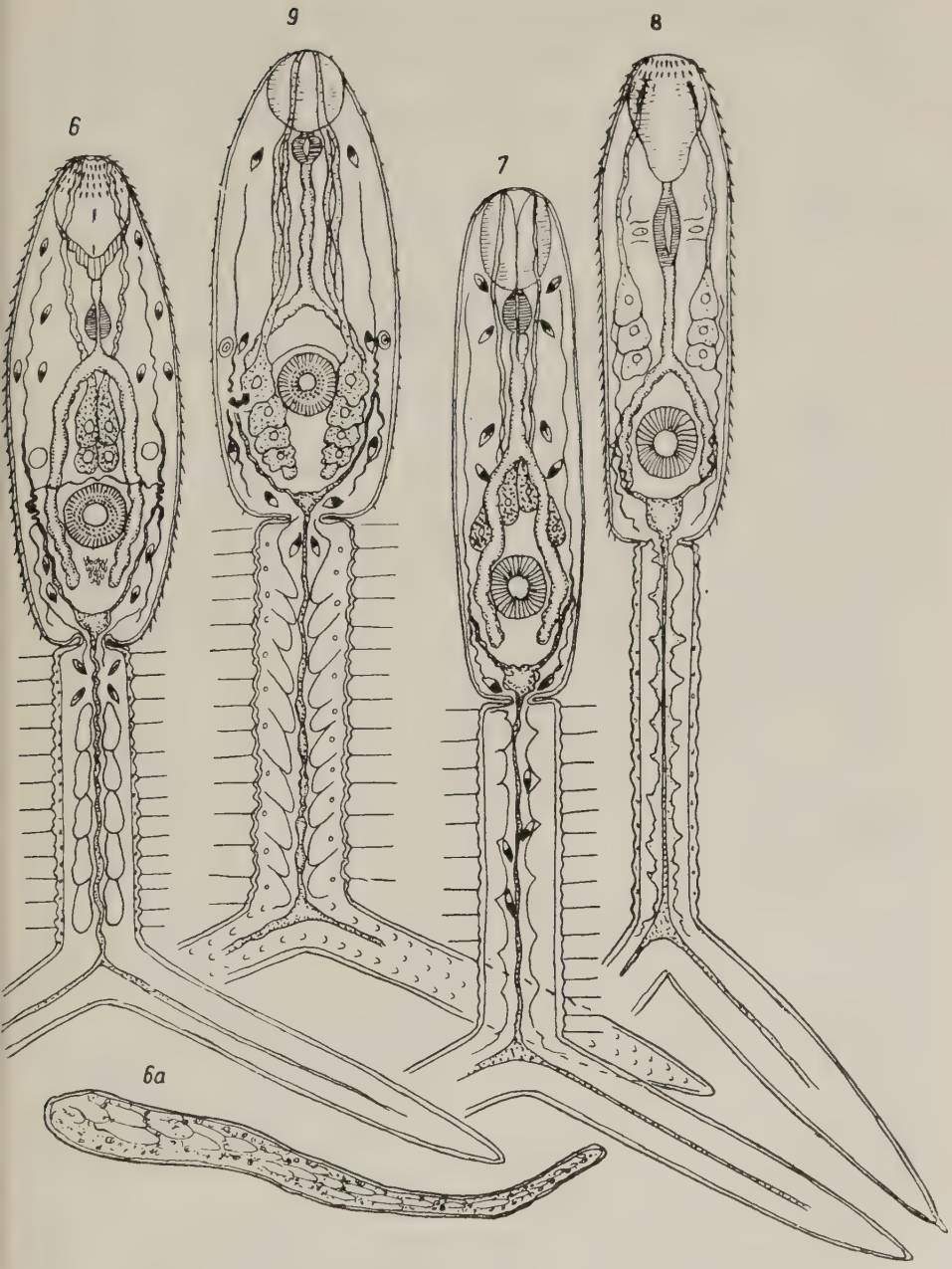

Fig. 6. Cercaria of *Cotylurus cornutus*. 6 a — sporocyst.
Fig. 7. Cercaria of *Tylodelphys excavata* (Rud.).
Fig. 8. *Cercaria linearis* Wes.-Lund.
Fig. 9. *Cercaria vilanoviensis* sp. n.

6. Cercaria of *Cotylurus cornutus* Rud. (Figs. 6 and 6 a)
(Cercaria of *Strigea tarda* Mathias, *Cercaria A* Szidat)

Dimensions of cercariae	Contracted	Relaxed
Length of body	90 μ	270 μ
Width of body	76	30
Length of tail	117	135
Width of tail	35	23
Furca	140	196
Anterior organ	28 × 23	42 × 23
Ventral sucker	25 × 25	32

The body is set with minute spines, which are arranged in the anterior organ more thickly and in several rows. The spines diminish in size towards the posterior part of the body. In addition to these, there are on the ventral sucker three rows of minute spines. The prepharynx and the oesophagus are short, pharynx muscled; the oesophagus forks into two branches extending to the excretory vesicle and encompassing bilaterally the ventral sucker. The penetrating glands occur as four cells before the ventral sucker between the intestinal branches; their efferent ducts pass the pharynx describing a wide loop and end at the apex of the anterior organ. From the small excretory vesicle, two efferent canals are leading towards the ventral sucker, and one canal towards the trunk of the tail. The efferent canals form loops at the level of the ventral sucker and branch out each into three canaliculi: the anterior, posterior, and transverse one. The transverse canalicule runs before the ventral sucker, interconnecting the anterior canaliculi from either side of the body. Before the site of juncture, there are on either side pigmentless eyes. Within the body there are 6 pairs of large flame cells, and further two pairs in the tail. The excretory duct passing through the tail trunk divides and each of the tubules runs in the furca and ends in the middle of the latter in an aperture. The tail contains 6—7 pairs of caudal corpuscles. The cuticle of the tail is folded and bilaterally armed with long bristles. The sporocysts are long and filiform; dimensions — 3000—4000 μ.

Wesenberg-Lund found cercaria of *Cotylurus cornutus* in *Limnaea stagnalis*, and Mathias reported it from several other snails, inclusive of *C. corneus*. In the environments of Warszawa I found it most frequently in the river Wilanówka. In the course

of further development the cercaria transforms in tetracotyle of *Cotylurus cornutus*, known from a number of different snail species. Final hosts are birds.

7. Cercaria of *Tylodelphys excavata* (R u d.) (Fig. 7)

The cercaria was reported originally by S z i d a t in 1935. It is very much like *C. letifera* described in greater detail by W e s e n b e r g-L u n d.

Dimensions of cercariae	Contracted	Relaxed
Length of body	76 μ	270 μ
Width of body	76	30
Length of tail	90	180
Width of tail	23	30
Furca	105 × 23	240 × 20
Anterior organ	55	
Ventral sucker	35	

The anterior part of the body is set with spines arranged in rows. The anterior organ is considerably larger than the ventral sucker, which is shifted onto the posterior part of body. It is equipped with a row of uncinate spines 3 μ. long and above 40 in number. The pharynx immediately adjoins the anterior organ; it subsequently expands and the expanded section merges into the oesophagus. Bifurcation of the alimentary canal takes place midway between the sucker and the anterior organ. The intestinal branches diverge most notably at the level of the ventral sucker and reach in the terminal section the excretory vesicle. There are four penetrating glands, and they consist each of a large cell with a conspicuous nucleus. The excretory vesicle is not large, and the canals leading from it fork on either side of the ventral sucker into anterior ones, extending to the anterior organ, and posterior ones, extending to the end of the body. I counted seven pairs of flame cells: 4 pairs in the anterior part of body, 1 in the posterior, and 2 pairs in the tail. I believe, however, that the number is not complete. The cuticle of the tail is folded, and set with bristles on either side of the trunk within which there are 6—7 pairs of caudal corpuscles. Sporocysts are filiform, long and mobile.

I found cercaria of *Tylodelphys excavata* in small numbers in water bodies of a natural character, most frequently in the river Wilanówka (frequency of infestation 0.31%).

8. *Cercaria linearis* Wes.-Lund (Fig. 8)

I found but a single specimen in the Gocławek pond. Its characteristic feature are three pairs of penetrating glands arranged laterally in front of the bifurcation of the intestine. Before the gland cells there are two colourless eye-spots. The anterior organ is set with spines arranged in two rows, 46 in each. Caudal furcae end in a small appendage. In the anterior organ the muscular section is fairly conspicuous. I found 6—7 caudal corpuscles in the tail. Dimensions are reasonably close to those quoted by Wesenberg-Lund.

Dimensions of cercariae	
Length of body	250 μ
Width of body	50
Length of tail	170
Width of tail	40
Furca	210
Anterior organ	25
Ventral sucker	45

The cercariae belong to flukes of the family *Strigeidae*.

9. *Cercaria vilanoviensis* sp.n. (Fig. 9)

In *Coretus corneus* I found twice cercariae which I was unable to identify with any of the species described in literature. Consequently, I report it as a new species.

Dimensions of cercariae	Contracted	Relaxed
Length of body	90 μ	302 μ
Width of body	75	25
Length of tail	180	166
Width of tail	77	30
Furca	226 × 33	335 × 30
Anterior organ	35 × 35	42 × 42
Ventral sucker	30	23 × 23
Pharynx	12 × 12	

The body is set with spines in the anterior part considerably more densely than in the posterior one. The anterior organ is circular in outline and is provided with a very thin layer of muscle fibres. The pharynx begins immediately behind the anterior organ; the oesophagus is long and forks but in the vicinity of the ventral

sucker into two thick intestinal branches extending as far as the excretory vesicle. The ventral sucker is shifted towards the end of the body and is provided with three rows of minute spines. Four pairs of gland cells are arranged on either side and behind the ventral sucker; the first pair lies on the level of the anterior margin of the ventral sucker. The cells are large, with large nuclei and a coarsely granular plasma. The excretory vesicle is small, and, when the cercaria relaxes, it extends along the main axis of the body. Excretory ducts fork at the level of the ventral sucker into anterior and posterior canaliculi; there is no transverse anastomosis. I noted four pairs of flame cells in the body and one in the tail. Before the ventral sucker there are two colourless eye-spots. The cuticle of the tail is folded and provided with long bristles. The anterior part of the tail is extended, much like in cercaria of *Bilharziella polonica*, but less so. In this slight extension, there may be seen muscle fibres. In the tail's trunk there are 9 pairs of caudal corpuscles, the first pair being larger than the remaining ones. The entire tail, furcae not excepting, is set with spines arranged in rows. Sporocysts are long and filiform.

Infestation was very low (0.07%), together with that of *C. linearis* the lowest found in *Coretus*.

CONCLUSIONS

1. Quantitatively, the range of infestation of fluke larvae in *Coretus corneus* is in the environments of Warszawa wide. I found cercariae of nine species and metacercariae of 3 species.

2. Presence of cercariae depends on the ecological character of the water body, associated with the presence or absence of final and intermediate hosts.

3. Maturing of the cercariae depends on the ambient temperature and the physiological state of the host. The effects of temperature account for the fact that mature cercariae appear in largest numbers in the summer months (June — August).

4. My material confirms the view that large-size snails are more frequently infected than smaller ones.

5. I have described the species of cercariae I found, of which three are new for systematics: *C. pilosa* sp.n., *C. pseudogracilis* n.nov., and *C. vilanoviensis* sp.n.

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STRESZCZENIE

W 1937 i 1938 r. autor zbadał 13122 *Coretus corneus*, pochodzących ze zbiorników wodnych okolic podwarszawskich. Znalazł w nich 9 gatunków cerkarii oraz 3 gatunki metacerkarii. Występowanie cerkarii uzależnione jest od charakteru ekologicznego zbiornika, co wiąże się z występowaniem w nich określonych żywicieli ostatecznych i pośrednich (płazów, ptaków i ślimaków). Dojrzewanie cerkarii zależy od temperatury otoczenia i od stanu fizjologicznego ślimaków. Wpływ temperatury na rozwój prowadzi do tego, że dojrzałe cerkarie pojawiają się w największej ilości w miesiącach letnich (czerwiec-sierpień). Na materiale *Coretus corneus* potwierdza się pogląd niektórych autorów, że ślimaki większe są częściej zarażone niż mniejsze. Autor podał opis znalezionych cerkarii: *Cercaria ephemera* Nitzsch, *Cercaria spinifera* La Val., *Cercaria pilosa* sp.n., *Cercaria pseudogracilis* n.nov., cercaria *Bilharziella polonica* Kow., cercaria *Cotylurus cornutus*, *Cercaria linearis* Wes.-Lund, cercaria *Tylodelphys excavata*, *Cercaria vilanoviensis* sp.n.